A METHOD OF CONCENTRATING PLANKTON WITHOUT NET OR FILTER

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Quantitative plankton studies have always been but approximate at best, because of the many sources of error met with in concentrating the organisms into a small volume of water by means of net or filter. And great difficulties have constantly beset planktologists in their endeavors to determine the quantitative value of these errors.

The Sedgwick-Rafter method seeks to eliminate the errors of the net-filter by filtering measured samples of water (taken by dipping or pumping) through a layer of sand, upon which the organisms are detained, to be afterward removed by washing the sand with a small measured portion of filtered or distilled water. While this method eliminates many sources of error, it does not avoid several others, such as the adhering of organisms to the sides of the funnel containing the sand, the passing of organisms between the sand grains, and the adhering of organisms to the sand grains in the processes of washing and decanting from the sand. Many who have used the net-filter method are well aware of the host of errors and difficulties that arise, such as the loss of the smaller planktonts passing through the meshes of the net, the clogging of the net, with its concomitant change of coefficient, and the elaborate and uncertain methods of determining the coefficient of the net.

In the early stages of my study of the plankton of Pertle Springs Lakes, I sought to obviate some of these errors and difficulties by devising a filter for filtering samples taken by dipping or by the plankton pump, without its usual filter. The filter succeeded in removing all planktonts from the water, even those as small as bacteria, but there was a slight loss in recovering them from the filter in the small volume of water representing the final concentration; and the time and labor incident to the manipulation of the air-pump attachment to my filter became a serious objection. To eliminate the errors and difficulties of the net-filter method, I devised a plan

which, so far as I have yet detected, is open to but two objections, both of which are of minor importance and can be overcome. This plan is the following: The samples are collected by dipping, or by the use of a plankton pump, without the filter. A measured quantity, say 500 c. c., is placed in a conical flask (Erlenmyer's) of say 750 c. c. capacity (so as not to make it too deep), 5 c. c. of 40 per cent formaldehyde added, and the two well mixed at once. All planktonts will soon die, and all or most of them will gradually settle to the bottom—*none* adhering to the sides. At the end of a sufficient period, say one week, the clear water is carefully siphoned off till about 150 c. c. remain. This partially concentrated sample, after mixing well, is poured into a conical flask of 150 c. c. capacity, and allowed to settle for another week. The siphoning is again done, carefully avoiding the drawing off of any of the plankton, and the well-mixed, concentrated sample transferred to a conical flask of 75 c. c. capacity. This flask has a base so small in diameter that all but about 20 c. c. can be safely siphoned away, and this final residue, containing practically all the plankton of the original sample, may be filed for later study in two 10 c. c. vials. After another week of settling, during which the vials should be slightly jarred a few times, to prevent adherence of organisms to the sides, a small portion of the clear fluid may be poured off, and about half a cubic centimeter of glycerine added, to serve as a preservative, as the formaldehyde may slowly evaporate. An occasional addition of a few drops of formaldehyde might the more certainly insure the preservation of the organisms, which are usually by this method in good condition for microscopic examination.

The chief source of error to be overcome in this method arises when there chances to be present some organisms, such as *Aphanizomenon,* whose specific gravity is not greater than that of water, and they thus fail to be drawn to the bottom by gravitation. Such organisms, however, can be secured by filtering the siphonate, and washing the filter with a small quantity of filtered or distilled water. Again, alcohol might be added till the specific gravity of the floating organisms is relatively great enough to cause them to sink. Of course the filtering will lose some organisms, and the alcohol would bleach them, but neither difficulty is very serious. It might be objected that this method will not secure sufficient quantities for accurate volumetric determinations, but this can be overcome by

using larger flasks for the first concentration, and by using slenderer graduated tubes for volumetric measurements. I am at present testing the details of a plan for overcoming this apparent objection.

I think it not essential for future plankton studies that they be made through the painful elaboration of methods of determining the coefficient of a costly filter-net, and the chilly process of filtering vast columns of cubic meters of water when the temperature above the ice ranges from 10° to —10° Fahrenheit.